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PATENT APPLICATION

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IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): GARCIA et al.

Confirmation No.: 7849

Application No.: 09/941,884

Examiner: NGUYEN, L.S.

Filing Date: Aug 28, 2001

Group Art Unit: 2853

Title: DIAGNOSTIC FOR VISUAL DETECTION OF MEDIA ADVANCE ERRORS

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on **Sep 24, 2004**.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $340.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

( ) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

( )	one month	$110.00
( )	two months	$430.00
( )	three months	$980.00
( )	four months	$1530.00

( ) The extension fee has already been filled in this application.

(X) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **08-2025** the sum of **$340.00**. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

(X) I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450. Date of Deposit: **Nov 19, 2004**

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Respectfully submitted,

GARCIA et al.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:

GARCIA et al.

Serial No. 09/941,884

Filed: 08/28/2001

For: DIAGNOSTIC FOR VISUAL DETECTION OF MEDIA ADVANCE ERRORS

Art Unit: 2853

Examiner: Nguyen, Lam S.

APPEAL BRIEF

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In re Application of:

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Art Unit: 2853

Examiner: Nguyen, Lam S.

APPEAL BRIEF

Commissioner for Patents
Alexandria, VA

Sir:

This appeal is taken from the Office's final rejection of Claims 1, 3-10, 12-18 and 22 mailed June 21, 2004, in the subject application.

I. REAL PARTY IN INTEREST.

The real party in interest is the assignee, Hewlett-Packard Development Company, L.P.

II. RELATED APPEALS AND INTERFERENCES.

There are no related appeals, interferences or judicial proceedings known to appellants, the appellants' legal representative, or assignee.

III. STATUS OF ALL THE CLAIMS.

Claims 1-22 were filed with this application. During the course of prosecution before the Primary Examiner, Claim 19 was cancelled. Claims 1-18 and 20-22 in their present, amended form appear in Appendix 1. Claims 2 and 11 have been allowed. Claims 1-18 and 20-22 are the only claims pending in this case. Claims 1, 3-10, 12-18 and 20-22 are at issue in this appeal.

IV. STATUS OF ALL AMENDMENTS FILED SUBSEQUENT TO FINAL REJECTION.

No amendments have been filed subsequent to the final rejection.

V. SUMMARY OF THE INVENTION.

The page and line numbers referred to herein are to the specification; reference characters are found in the drawing.

Independent Claim 1 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

entering a diagnostic mode of the printing system in which mode normal printing jobs of the printing system are not printed **[9:4-7; FIG. 13, 200; FIG. 14, 220]**;

printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]**; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 228]**.

Claim 3 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

during a diagnostic mode of the printing system in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas, **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]** wherein said different areas are nominally aligned along a horizontal line **[FIGS. 11, 12]**; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

Claim 4 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]**; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action, wherein said step of examining the diagnostic pattern is conducted visually by a user **[FIG. 13, 208; 17:15-22]**.

Claim 6 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

checking for printhead health and taking any corrective needed action to recover nozzle health **[16:28 to 17:14; FIG. 13, 206-207]**;

during a diagnostic mode in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]**; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

Claim 8 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

during a diagnostic mode of the printing system in which normal printing jobs of the printing system are not printed **[9:4-7; FIG. 13, 200; FIG. 14, 220]**, printing different areas of a diagnostic pattern at different

passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]**, said printing different areas of a diagnostic pattern comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, and wherein said diagnostic print mode mask defines that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i) **[9:23 to 13:7; FIGS. 9 and10A-10C]**; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

Claim 9 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

during a diagnostic mode of the printing system in which normal printing jobs of the printing system are not printed **[9:4-7; FIG. 13, 200; FIG. 14, 220]**, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]**, said printing of a diagnostic pattern comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, said diagnostic print mode mask defines that the first w/2

pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i), wherein said diagnostic print mode mask includes a row wherein said first w/2 pixels are printed in a first pass, and said last w/2 pixels are printed in a last pass of said plurality of passes **[9:23 to 13:7; FIGS. 9 and10A-10C]**; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

Claim 10 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead **[38, FIG. 2]** mounted on a carriage, the carriage **[31, FIG. 2]**mounted for movement along a scan axis **[15, FIG. 2]**;

providing a media advance system **[35, FIG. 3]** for advancing a print medium **[33, FIG. 1]** along a media path **[13, FIG. 1]** which is transverse to the scan axis;

entering a diagnostic multi-pass print mode in which mode normal printing jobs of the printing system are not printed **[9:4-7; FIG. 13, 200; FIG. 14, 220]**;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]**; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

Claim 13 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead **[38, FIG. 2]** mounted on a carriage **[31, FIG. 2]**, the carriage mounted for movement along a scan axis **[15, FIG. 2]**;

providing a media advance system **[35, FIG. 3]** for advancing a print medium **[33, FIG. 1]** along a media path which is transverse to the scan axis **[13, FIG. 1]**;

entering a diagnostic multi-pass print mode **[9:4-7; FIG. 13, 200; FIG. 14, 220]**;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]**; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action, wherein said step of examining the diagnostic pattern is conducted visually by a user **[FIG. 13, 208; 17:15-22]**.

Claim 15 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead **[38, FIG. 2]** mounted on a carriage **[31, FIG. 2]**, the carriage mounted for movement along a scan axis **[15, FIG. 2]**;

providing a media advance system **[35, FIG. 3]** for advancing a print medium along a media path which is transverse to the scan axis **[13, FIG. 1]**;

entering a diagnostic multi-pass print mode **[9:4-7; FIG. 13, 200; FIG. 14, 220]**;

checking for printhead health and taking any corrective needed action prior to printing a diagnostic pattern **[16:28 to 17:14; FIG. 13, 206-207]**;

printing different areas of the diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas **[FIG. 13, 208; FIG. 14, 222; 9:4 to 15-9]**; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

Claim 17 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead **[38, FIG. 2]** mounted on a carriage **[31, FIG. 2]**, the carriage mounted for movement along a scan axis **[15, FIG. 2]**;

providing a media advance system **[35, FIG. 3]** for advancing a print medium along a media path **[13, FIG. 1]** which is transverse to the scan axis;

entering a diagnostic multi-pass print mode **[9:4-7; FIG. 13, 200; FIG. 14, 220]**;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas **[9:4-7; FIG. 13, 200; FIG. 14, 220]**, said printing different areas of a diagnostic plot comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, wherein said diagnostic print mode mask defines that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i) **[9:23 to 13:7; FIGS. 9 and10A-10C]**; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

Claim 18 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead **[38, FIG. 2]** mounted on a carriage, the carriage **[31, FIG. 2]** mounted for movement along a scan axis **[15, FIG. 2]**;

providing a media advance system **[35, FIG. 3]** for advancing a print medium along a media path **[13, FIG. 1]** which is transverse to the scan axis;

entering a diagnostic multi-pass print mode **[9:4-7; FIG. 13, 200; FIG. 14, 220]**;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas **[9:4-7; FIG. 13, 200; FIG. 14, 220]**, said printing different areas of a diagnostic plot comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, said diagnostic print mode mask defining that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i), wherein said diagnostic print mode mask includes a row wherein said first w/2 pixels are printed in a first pass, and said last w/2 pixels are printed in a last pass of said plurality of passes **[9:23 to 13:7; FIGS. 9 and10A-10C]**; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

Claim 20 is drawn to a multi-pass diagnostic print mode mask **[110, FIG. 10A]** for visual detection of poor media advance calibration in an ink-jet printing system including a printhead having a nozzle array, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of

pixels and a row width of w pixels, with each pixel location having a number associated therewith, the number representing the pass in which the pixel will be printed, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, wherein said diagnostic print mode mask defining that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i) **[9:23 to 13:7; FIGS. 9 and 10A-10C]**.

Claim 21 is drawn to a multi-pass diagnostic print mode mask **[110, FIG. 10A]** for visual detection of poor media advance calibration in an ink-jet printing system including a printhead having a nozzle array, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, said diagnostic print mode mask defining that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i), and wherein said diagnostic print mode mask includes a row wherein said first w/2 pixels are assigned to be printed in a first pass, and said last w/2 pixels are assigned to be printed in a last pass of said plurality of passes **[9:23 to 13:7; FIGS. 9 and 10A-10C]**.

Claim 22 is drawn to a diagnostic method for improving print quality in an ink-jet printing system, comprising:

providing an ink-jet printhead **[38, FIG. 2]** mounted on a carriage **[31, FIG. 2]**, the carriage mounted for movement along a scan axis **[15, FIG. 2]**;

providing a media advance system **[35, FIG. 3]** for advancing a print medium along a media path **[13, FIG. 1]** which is transverse to the scan axis;

entering a diagnostic multi-pass print mode **[9:4-7; FIG. 13, 200; FIG. 14, 220]**;

determining whether the nozzle array has good health **[16:28 to 17:14; FIG. 13, 206-207]**;

if the nozzle array has good health, printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas **[9:4-7; FIG. 13, 200; FIG. 14, 220]**; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action **[FIG. 13, 208; FIG. 14, 224]**.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL.

The grounds of rejection to be reviewed on appeal are:

(i) whether Claims 1, 3, 5-6, 10, 14-15 and 2 are unpatentable under 35 USC 103(a) over Dunand (US 6,398,334) in view of Takagi et al. ("Takagi") (US 6,089,695),

(ii) whether Claims 7 and 16 are unpatentable under 35 USC 103(a) over Dunand in view of Takagi and further in view of Maeda et al ("Maeda") (US 6,334,659),

(iii) whether Claims 8-9, 12, 17-18 and 20-21 are unpatentable under 35 USC 103(a) over Dunand in view of Takagi and further in view of Yen et al ("Yen") (US 6,334,659), and

(iv) whether Claims 4 and 13 are unpatentable over Dunand in view of Takagi and Otsuki et al. ("Otsuki) (US 6,196,736).

VII. ARGUMENT.

A. The Requirements of 35 USC §103.

35 USC §103 requires that the invention as a whole must be considered in obviousness determinations. The invention as a whole embraces the structure, its properties and the problem it solves. In re Wright, 6 USPQ2d 1959, 1961 (Fed.Cir. 1988).

In order to provide a basis for obviousness, the applied references must be related to the subject matter of the invention in issue and must suggest (expressly or by implication) the combination of the invention in issue. In re Sernaker, 702 F.2d 989 (Fed.Cir. 1983).

Further, the combined teachings of the prior art references should suggest the advantage of combining the teachings. In re Sernaker, supra, at 995-996.

In determining the combined teachings of the applied references, the subject matter of the claimed invention must not be utilized to provide hindsight reconstruction of the applied references. As stated by the Court of Customs and Patent Appeals In re Shuman, 361 F.2d 1008 (CCPA 1966):

> It is impermissible to first ascertain factually what appellant did and then view the prior art in such a manner as to select from the random facts of that art only those which may be modified and then utilized to reconstruct appellants' invention from such prior art. 361 F.2d at 1012.

The Examiner bears the burden of establishing a prima facie case of obviousness based on the prior art. "... 'This burden can be satisfied only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.' The patent applicant may then attack the Examiner's prima facie determination as improperly made out, or the applicant may present objective evidence tending to support a conclusion of nonobviousness." In re Fritch, 23 USPQ 1780, 1783 (Fed.Cir. 1992).

Appellants submit that the Primary Examiner has not established prima facie that the claimed invention would have been obvious in view of the applied references, and that the references do not teach or suggest the claimed invention.

B. A Prima Facie Case of Obviousness Has Not Been Established.

For purposes of this appeal, appellants are content to stand on the differences between the claimed invention and the applied references discussed below, because these differences are sufficient to establish that a prima facie case of obviousness has not been established, and the applied references do

not teach or suggest appellants' invention. Appellants do not concede, however, that other differences do not exist.

Claims 1, 3, 5-6, 10, 14-15 and 2 stand rejected as being unpatentable under 35 USC 103(a) over Dunand in view of Takagi. This ground of rejection should be reversed on the grounds that a prima facie case of obviousness has not been established, and the applied references do not teach or suggest the claimed subject matter.

Dunand describes a process for compensation of a defect in the advance of a print substrate by modifying the arrival position of ink droplets with a variable electrical charge on the substrate. Each band of droplets is printed with a mark on the margin or edge of the substrate, the substrate is advanced to print the next band, an algebraic difference is determined between a nominal theoretical position of the mark and the real position of the mark, a correction to the value of the charge voltage to be applied to each droplet to compensate for the position error is determined, and the substrate correction is applied to each droplet in the next band, in addition to the nominal voltage. (Abstract) Thus, the printing of the mark is performed during printing of normal print jobs.

Claim 1 recites a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

> entering a diagnostic mode of the printing system in which mode normal printing jobs of the printing system are not printed;
>
> printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas; and
>
> examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

Dunand does not disclose entering a diagnostic mode as recited in Claim 1. This is undisputed.

The Examiner alleges Takagi discloses a process in a printer comprising a step of entering a diagnostic mode of the printing system in which normal printing jobs are not printed (FIG. 12A, step S102: PRINT DETECTION

PATTERN), and an initial step of checking for printhead heath (FIG. 12, step S104: NON-DISCHARGE NOZZLE IS PRESENT) and taking any corrective needed action prior to printing said diagnostic pattern (Abstract: After abnormal nozzles are detected, data related to such abnormal nozzles are removed).

Takagi describes a recording apparatus to perform complementary recording to eliminate a white streak caused by recording elements becoming incapable of recording. Preceding printing, abnormal nozzles are detected, and data related to the abnormal nozzles are removed. One scan printing is performed in accordance with such data. Preceding the returning operation of the printing head subsequent to the one scan, a sub-scanning operation is performed so that normal nozzles are positioned in a location corresponding to the white streak appearing in the one scan printing. While returning the printing head, the printing is performed in accordance with such data related to the abnormal nozzles detected at the time of one scan, hence executing a complementary recording appropriately. (Takagi, Abstract)

Takagi thus has nothing to do with the problem of poor media advance calibration in an ink-jet printing system. Instead, Takagi addresses a case in which a nozzle of the printhead is not printing normally. The diagnostic mode of Takagi does not print different areas of a diagnostic pattern at different passes with a controlled amount of media advance between the passes, to accumulate media advance error. Nor is there any teaching in Takagi to examine a diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

The Examiner states that it would have been obvious to modify "the printing process disclosed by Dunand such that including the step of entering diagnostic mode that checks printhead health and takes any corrective needed action as disclosed by Takagi et al. The motivation of doing so is to provide a liquid discharge apparatus capable of obtaining the desired result of discharges without any defects even when non-discharge or another malfunction occurs in the discharging means as taught by Takagi." (Page 3 of Final Rejection) Appellants respectfully disagree.

Modifying Dunand with teachings of Takagi would at most result in a printing system with a diagnostic mode having an abnormal nozzle detection scheme, and using a sub-scanning operation to fill in white streaks caused by

the abnormal nozzle. The diagnostic method of Claim 1 still does not result from the purported modification.

The Federal Circuit stated the law of obviousness in In re Kotzab, 55 USPQ 2d 1313, 1316-1317 (Fed.Cir. 2000):

> "A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field... Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one 'to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher,"... [citations omitted]
>
> Most if not all inventions arise from a combination of old elements... Thus, every element of a claimed invention may often be found in the prior art... However, identification in the prior art of each individual part claimed is insufficient to defeat patentability of the whole claimed invention... Rather, to establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant... Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference...." [citations omitted]

Here, there has been no showing of a suggestion or motivation to modify Dunand to arrive at the claimed invention. Takagi is cited as supplying teachings admittedly missing from Dunand, yet there is no teaching or suggestion from Takagi to modify Dunand with a diagnostic mode as in Claim 1. Dunand teaches measuring the position of a mark printed during each swath of a print job, and correcting a voltage applied to drops during printing of the next swath. Dunand does not teach or suggest a diagnostic mode as recited in Claim 1. Appellants respectfully submit that the combination of references to form the grounds for the rejection is the product of improper hindsight reconstruction, using only appellants' specification as a blue print in an attempt to find isolated elements of the claimed invention.

The Examiner has further alleged at page 7 of the final rejection that the secondary reference Takagi "implicitly teaches an advantage of taking a detecting step preceding printing to make sure the printing operation is adjusted, set up, or controlled in accordance with the result from the detecting step in order to gain printing quality. Therefore, one of ordinary skill in the art would have motivation to modify Dunand's method by having the diagnostic step to be done prior the printing step in order to be able to control the printing operation based on the result of the diagnostic step to avoid undesired result on printed images due to variations of the printing mechanism (the nature of problem is solved)." Appellants respectfully disagree.

Takagi teaches detecting abnormal nozzles and removal of data for these nozzles. The Examiner has attempted to attribute a broad "implicit" teaching to this reference, but such allegation is unsupported by the reference. Moreover, even if Dunand is modified with teachings of Takagi, appellants' claimed invention is not obtained, as noted above.

Similar considerations apply to Claims 3, 6, 10, 15 and 22.

Claim 3 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

> during a diagnostic mode of the printing system in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas, wherein said different areas are nominally aligned along a horizontal line; and
>
> examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

A prima facie case of obviousness of the subject matter of Claim 3 has not been established. Limitations of Claim 3 are not even addressed in the final rejection, including that "said different areas are nominally aligned along a horizontal line." This feature further distinguishes Claim 3 from the alleged combination of Dunand and Takagi.

Claim 6 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

checking for printhead health and taking any corrective needed action to recover nozzle health;

during a diagnostic mode in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

Claim 6 is even further distinguished from the combination of Dunand and Takagi because Takagi does not take any needed corrective action to recover nozzle health.

Claim 10 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode in which mode normal printing jobs of the printing system are not printed;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

Claim 10 is further distinguished from the combination of Dunand and Takagi, because neither reference discloses entering a diagnostic multi-pass print mode as recited in Claim 10. Claims 15 and 22 also recite “entering a

diagnostic multi-pass print mode" and are also further distinguished from the applied references.

Claim 15 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode;

checking for printhead health and taking any corrective needed action prior to printing a diagnostic pattern;

printing different areas of the diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

The rejection of Claim 15 should be reversed for the reasons discussed above regarding Claim 1, and further because neither applied reference teaches or suggests "entering a diagnostic multi-pass print mode."

Claim 22 is drawn to a diagnostic method for improving print quality in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode;

determining whether the nozzle array has good health;

if the nozzle array has good health, printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

The rejection of Claim 22 should be reversed for the reasons discussed above regarding Claim 1, and further because neither applied reference teaches or suggests "entering a diagnostic multi-pass print mode."

Because a prima facie case of obviousness has not been established, the rejection of Claims 1, 3, 5-6, 10, 14-15 and 22 should be withdrawn.

Claims 7 and 16 stand rejected under 35 USC 103 as being unpatentable over Dunand in view of Takagi and Maeda. This ground of rejection is respectfully traversed, for reasons discussed above regarding Claims 1 and 10. A prima facie case of obviousness has not been established.

Claim 7 depends from Claim 1, and further recites that the step of printing different areas of a diagnostic plot includes:

applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels, with each pixel location having a number associated therewith, the number representing the pass in which the pixel will be printed, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed.

Claim 16 depends from Claim 10, and further recites that the step of printing different areas of a diagnostic plot includes:

applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels, with each pixel location having a number associated therewith, the number representing the pass in which the pixel will be printed, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein

said first set of pixels is printed on a different pass than said second set of pixels is printed.

The Examiner agrees that Dunand and Takagi do not disclose the features of dependent Claims 7 and 16. Maeda is cited as allegedly showing printing different areas of a diagnostic plot. Applicants respectfully disagree with the recitation of the alleged teachings of Maeda. The embodiment illustrated in FIGS. 7-10 of Maeda is directed to the problem of an ink drawing phenomenon causing bleeding, resulting from laying down a dot right next to a just previously deposited dot. By depositing respective dots in a checkerboard fashion, the ink drawing phenomenon is said to be avoided. FIGS. 10A-10D show the technique of checkerboard printing using respective mask patterns. See, Maeda at 10:35 to 11:54.

The passages of Maeda cited by the Examiner do not pertain to a "diagnostic plot," or a "diagnostic multi-pass print mode mask," but rather to techniques of printing to avoid bleed during normal print operations.

Because Dunand and Takagi admittedly do not show the features of Claims 7 and 16, and because Maeda does not supply the missing teachings of these claims, a prima facie case of obviousness has not been established. Applicants respectfully submit that the combination of references to form the grounds for the rejection is the product of improper hindsight reconstruction.

The Examiner further states that it would have been obvious to include the applying of a diagnostic multi-pass print mode mask as allegedly disclosed by Maeda into the advance control process as disclosed by Dunand, as modified, and that the motivation for doing so is to reduce the formed bind pitch to less that paper transport width without increasing the number of scans, so that banding artifacts are imperceptible as taught by Maeda at 4:4-10. The problem addressed by Maeda has nothing to do with the problem of media advance errors, and so the motivation asserted by the Examiner would not lead one to the solution set out in Claims 7 and 16.

Claims 8-9, 12, 17-18 and 20-21 stand rejected under 35 USC 103 as being unpatentable over Dunand in view of Takagi and Yen et al. ("Yen"). This rejection is respectfully traversed on the ground that a prima facie case of obviousness has not been established, and the applied references do not teach or suggest the claimed invention.

Claim 8 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

during a diagnostic mode of the printing system in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas, said printing different areas of a diagnostic pattern comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, and wherein said diagnostic print mode mask defines that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i); and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

Dunand and Takagi have been discussed above, and does not teach or suggest the features of these claims, for reasons similar to those discussed above regarding Claim 1.

Yen is cited as allegedly disclosing "printing patterns including the first w/2 pixels in the row are printed in the same pass, and the last w/2 pixels in the row are printed in another pass, wherein said diagnostic print mode mask includes a row wherein said first w/2 pixels are printed in a first pass, and said last w/2 pixels are printed in a last pass of said plurality of passes (FIG. 6), and wherein said different areas are nominally aligned along a horizontal line (FIG. 3)." Applicants respectfully deny that Yen discloses the foregoing teachings.

The Examiner holds that it would have been obvious to "modify the diagnostic print pattern disclosed by Dunand as modified such as the first w/2 pixels are printed in a first pass and the last w/2 pixels are printed in a last pass of said plurality of passes as disclosed by Yen et al. The motivation of doing so

is to eliminate unpleasant banding artifacts caused by ink migration as taught by Yen et al. (Abstract)." Applicants respectfully disagree with this holding.

Yen discloses a mask pattern having 4 by 4 triangular tiling clusters, as shown in FIG. 6, which provide a balance between reduction of banding artifacts and increase in image granularity. The mask pattern is not described as a diagnostic print mask, nor does Yen describe printing a diagnostic pattern. The Examiner refers to FIG. 3 as allegedly disclosing "said different areas are nominally aligned along a horizontal line," yet FIG. 3 is said to be a printed image produced by an inkjet printer, effectively 60x magnified to show a banding phenomenon. (1: 61-65) It is not seen how this figure supports the Examiner's contentions.

Further, there appears no logical reason to modify Dunand as suggested by the Examiner. Apparently the modification would result in the marks printed in the margin being printed in different passes. Yet this modification does not result in a diagnostic method meeting the claim limitations, e.g. that the different passes be printed with a controlled amount of media advances between the passes. Here again, the rejection appears to be the product of attempted improper hindsight reconstruction, without reasoning clearly supporting the modification.

Similar considerations apply to Claims 9, 12, 17 and 18.

Claim 20 is drawn to a multi-pass diagnostic print mode mask for visual detection of poor media advance calibration in an ink-jet printing system including a printhead having a nozzle array, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, with each pixel location having a number associated therewith, the number representing the pass in which the pixel will be printed, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, wherein said diagnostic print mode mask defining that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i).

The Examiner alleges that Yen discloses a diagnostic print mode mask, referring to FIG. 6 of Yen. However, FIG. 6 appears to show a print mask which

is used during normal printing, and not a diagnostic print mode mask as recited in Claim 20.

Similar consideration apply to Claim 21.

Claims 4 and 13 stand rejected as being unpatentable over Dunand in view of Takagi and Otsuki et al. ("Otsuki"). This ground of rejection is respectfully traversed, on the grounds that a prima facie case of obviousness has not been established, and the applied references do not teach or suggest the claimed invention.

Claim 4 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

> printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas; and
>
> examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action, wherein said step of examining the diagnostic pattern is conducted visually by a user.

The Examiner alleges that Dunand as modified discloses the claimed invention, except where the "step of examining the diagnostic pattern is conducted visually by a user." Otsuki is cited as allegedly disclosing a process in a printer including a step of examining the diagnostic pattern visually by a user. The Examiner holds that it would have been obvious to modify the examining process of the diagnostic pattern of Dunand such that the diagnostic pattern is conducted visually by a user as disclosed by Otsuki, and that the motivation of doing so is to correct the advance media error by inputting correction values or adjusting parameters of the system which are done by the user as taught by Otsuki. Applicants respectfully traverse this holding.

Dunand as modified has been discussed above. Dunand describes printing a mark on each swath during normal printing, and measuring the position of that mark against its nominal position. One of ordinary skill would not replace the optical sensor system of Dunand with a manual system of user examination, for several reasons. One is that a user would be extremely unlikely to be able to visually measure the position of a mark against some nominal

position. A second reason is that printing speed would be slowed to a virtual crawl, since a measurement is made on each swath. Essentially, the modification suggested by the Examiner would render the printer of Dunand unsatisfactory for its intended purpose; in such a case, there is no suggestion or motivation to make the proposed modification. MPEP 2143.01; In re Gordon, 221 USPQ 1125 (Fed.Cir. 1984).

Claim 13 is drawn to a diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action, wherein said step of examining the diagnostic pattern is conducted visually by a user.

Similar considerations apply to Claim 13 as discussed above regarding Claim 4, Further, Dunand as modified does not disclose all features of Claim 13 except for user examination of a diagnostic pattern, including for example "entering a diagnostic multi-pass print mode" and "printing different passes of a diagnostic plot at different passes...". Thus, Claim 13 is further distinguished from the Examiner's combination of references.

VII. SUMMARY

The rejections under 35 USC § 103 must be reversed. A prima facie case of obviousness has not been made, and the cited references do not teach or suggest the claimed invention.

Respectfully submitted,

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APPENDIX I

1. (Previously presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

entering a diagnostic mode of the printing system in which mode normal printing jobs of the printing system are not printed;

printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

2. (Previously Presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

entering a diagnostic mode of the printing system in which mode normal printing jobs of the printing system are not printed;

printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action; and

wherein said printing different areas comprises:

printing a first area comprising a first set of pixels printed during a first pass;

conducting a plurality of incremental media advances;

printing a further area comprising a second set of pixels printed during a further pass, wherein media advance errors resulting from said plurality of media advances are accumulated between printing said first area and printing said further area.

3. (Previously Presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

during a diagnostic mode of the printing system in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas, wherein said different areas are nominally aligned along a horizontal line; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

4. (Previously presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action, wherein said step of examining the diagnostic pattern is conducted visually by a user.

5. (Original) The method of Claim 1, wherein said step of examining the diagnostic pattern is conducted by an optical sensor comprising the printing system.

6. (Previously Presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

checking for printhead health and taking any corrective needed action to recover nozzle health;

during a diagnostic mode in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

7. (Original) The method of Claim 1, wherein said step of printing different areas of a diagnostic plot includes:

applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels, with each pixel location having a number associated therewith, the number representing the pass in which the pixel will be printed, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed.

8. (Previously Presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

during a diagnostic mode of the printing system in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas, said printing different areas of a diagnostic pattern comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, and wherein said diagnostic print mode mask defines that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i); and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

9. (Previously presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

during a diagnostic mode of the printing system in which normal printing jobs of the printing system are not printed, printing different areas of a diagnostic

pattern at different passes of one or more ink-jet printheads with a controlled amount of media advances between the passes, to accumulate media advance error between the printing of the different areas, said printing of a diagnostic pattern comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, said diagnostic print mode mask defines that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i), wherein said diagnostic print mode mask includes a row wherein said first w/2 pixels are printed in a first pass, and said last w/2 pixels are printed in a last pass of said plurality of passes; and

examining the diagnostic pattern to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action,.

10. (Previously Presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode in which mode normal printing jobs of the printing system are not printed;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

11. (Previously Presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode in which mode normal printing jobs of the printing system are not printed;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action; and

wherein said printing different areas comprises:

printing a first area comprising a first set of pixels printed during a first pass;

conducting a plurality of incremental media advances;

printing a further area comprising a second set of pixels printed during a further pass, wherein media advance errors resulting from said plurality of media advances are accumulated between printing said first area and printing said further area.

12. (Original) The method of Claim 10 wherein said different areas are nominally aligned along a horizontal line.

13. (Previously presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action, wherein said step of examining the diagnostic pattern is conducted visually by a user.

14. (Original) The method of Claim 10, wherein said step of examining the diagnostic pattern is conducted by an optical sensor comprising the printing system.

15. (Previously presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode;

checking for printhead health and taking any corrective needed action prior to printing a diagnostic pattern;

printing different areas of the diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

16. (Original) The method of Claim 10, wherein said step of printing different areas of a diagnostic plot includes:

applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels, with each pixel location having a number associated therewith, the number representing the pass in which the pixel will be printed, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed.

17. (Previously Presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas, said printing different areas of a diagnostic plot comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, wherein said diagnostic print mode mask defines that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i); and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

18. (Previously Presented) A diagnostic method for visual detection of poor media advance calibration in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode;

printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas, said printing different areas of a diagnostic plot comprising applying a diagnostic multi-pass print mode mask, wherein a plurality of carriage passes are

employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, said diagnostic print mode mask defining that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i), wherein said diagnostic print mode mask includes a row wherein said first w/2 pixels are printed in a first pass, and said last w/2 pixels are printed in a last pass of said plurality of passes; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.

19. (Canceled)

20. (Previously Presented) A multi-pass diagnostic print mode mask for visual detection of poor media advance calibration in an ink-jet printing system including a printhead having a nozzle array, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, with each pixel location having a number associated therewith, the number representing the pass in which the pixel will be printed, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first set of pixels is printed on a different pass than said second set of pixels is printed, wherein said diagnostic print mode mask defining that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i).

21. (Previously Presented) A multi-pass diagnostic print mode mask for visual detection of poor media advance calibration in an ink-jet printing system including a printhead having a nozzle array, wherein a plurality of carriage passes are employed to print the area subtended by a printhead nozzle array, the diagnostic print mode mask comprising a rectilinear grid of pixels and a row width of w pixels, and wherein said different areas include a first set of pixels on a row of said grid, and a second set of pixels on said row, and wherein said first

set of pixels is printed on a different pass than said second set of pixels is printed, said diagnostic print mode mask defining that the first w/2 pixels in the row are printed in the same pass (a_i), and the last w/2 pixels in the row are printed in another pass (b_i), and wherein said diagnostic print mode mask includes a row wherein said first w/2 pixels are assigned to be printed in a first pass, and said last w/2 pixels are assigned to be printed in a last pass of said plurality of passes.

22. (Original) A diagnostic method for improving print quality in an ink-jet printing system, comprising:

providing an ink-jet printhead mounted on a carriage, the carriage mounted for movement along a scan axis;

providing a media advance system for advancing a print medium along a media path which is transverse to the scan axis;

entering a diagnostic multi-pass print mode;

determining whether the nozzle array has good health;

if the nozzle array has good health, printing different areas of a diagnostic plot at different passes using said ink-jet printhead with a controlled amount of media advances between the passes to accumulate media advance error between the printing of the different areas; and

examining the diagnostic plot to determine whether the accumulated media advance error is sufficiently objectionable to take corrective action.